Topic: Linear approximation

Question: Find the linear approximation of the function at the given point.

$$f(x) = x^2$$

at $a = 1$

Answer choices:

A $L(x) = 2x - 1$

B $L(x) = -2x - 1$

C $L(x) = 2x + 1$

D $L(x) = 1 - 2x$

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Solution: A

To find the linear approximation of a function $f(x)$ we will use the formula

$$L(x) = f(a) + f'(a)(x - a)$$

where $f(a)$ is the given function at point a and $f'(a)$ is the derivative of the given function at point a.

We can start by taking the derivative of the function $f(x) = x^2$.

$$f'(x) = 2x$$

Now we can find $f(a)$ where $a = 1$.

$$f(1) = (1)^2$$

$$f(1) = 1$$

Next we'll find $f'(a)$ where $a = 1$.

$$f'(1) = 2(1)$$

$$f'(1) = 2$$

Finally, we can substitute these pieces into the linear approximation formula.

$$L(x) = 1 + (2)(x - 1)$$

$$L(x) = 1 + 2x - 2$$

$$L(x) = 2x - 1$$

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The linear approximation of $f(x) = x^2$ is $L(x) = 2x - 1$.

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Topic: Linear approximation

Question: Find the linear approximation of the function at the given point.

$$f(x) = 3x^2 - 6x + 1$$

at $a = 0$

Answer choices:

A $L(x) = 1 + 6x$

B $L(x) = -1 - 6x$

C $L(x) = 1 - 6x$

D $L(x) = -1 + 6x$

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Solution: C

To find the linear approximation of a function $f(x)$ we will use the formula

$$L(x) = f(a) + f'(a)(x - a)$$

where $f(a)$ is the given function at point a and $f'(a)$ is the derivative of the given function at point a.

We can start by taking the derivative of the function $f(x) = 3x^2 - 6x + 1$.

$$f'(x) = 6x - 6$$

Now we can find $f(a)$ where $a = 0$.

$$f(0) = 3(0)^2 - 6(0) + 1$$

$$f(0) = 1$$

Next we'll find $f'(a)$ where $a = 0$.

$$f'(0) = 6(0) - 6$$

$$f'(0) = -6$$

Finally, we can substitute these pieces into the linear approximation formula.

$$L(x) = 1 + (-6)(x - 0)$$

$$L(x) = 1 - 6x$$

The linear approximation of $f(x) = 3x^2 - 6x + 1$ is $L(x) = 1 - 6x$.

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Topic: Linear approximation

Question: Find the linear approximation of the function at the given point.

$$f(x) = (x + 4)^2$$

at $a = 2$

Answer choices:

A $L(x) = 1 + x$

B $L(x) = 12 + 12x$

C $L(x) = -12 - 12x$

D $L(x) = 1 - x$

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Solution: B

To find the linear approximation of a function $f(x)$ we will use the formula

$$L(x) = f(a) + f'(a)(x - a)$$

where $f(a)$ is the given function at point a and $f'(a)$ is the derivative of the given function at point a.

We can start by taking the derivative of the function $f(x) = (x + 4)^2$.

$$f'(x) = 2(x + 4)(1)$$

$$f'(x) = 2x + 8$$

Now we can find $f(a)$ where $a = 2$.

$$f(2) = (2 + 4)^2$$

$$f(2) = 36$$

Next we'll find $f'(a)$ where $a = 2$.

$$f'(2) = 2(2) + 8$$

$$f'(2) = 12$$

Finally, we can substitute these pieces into the linear approximation formula.

$$L(x) = 36 + (12)(x - 2)$$

$$L(x) = 36 + 12x - 24$$

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$$L(x) = 12 + 12x$$

The linear approximation of $f(x) = (x + 4)^2$ is $L(x) = 12 + 12x$.

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